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ABSTRACT

Students enter teacher education programs with pre-existing beliefs about the teacher's role, what constitutes effective teaching, teacher planning, and knowledge structures. This case study examines the changes in one preservice science teacher's attitude and beliefs towards the teaching of creationism as a result of her personal inquiry. The student was a female, 28-year-old nontraditional student, enrolled in the undergraduate introductory course of a 2-year secondary education course of study at an urban southwestern state university. Data was collected from a questionnaire, early microteaching lessons, concept maps of teaching, reflective papers, student learning journals, interviews, and a field paper of an in-depth personal inquiry into the teaching of creationism. Findings indicated that as a result of her personal investigation, the student changed her beliefs about the teaching of the origin of life in the science classroom. The paper concludes that teacher educators can invite critical inquiry into attitudes and beliefs about teaching and prepare teachers with sound rationales for teaching, if their views about what to teach and how to teach are tested from a constructivist approach. Contains 17 references. (MDH)

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The Constructivist Transformation of a Preservice Teacher's Views on Teaching Creationism and Evolution

National Association for Research in Science Teaching
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ED 361 210

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The general purpose of this study was to explore the consequences of a constructivist approach to an introductory course in teacher education and investigate the changes that resulted in preservice teachers attitudes and beliefs about science teaching. Molly, a twenty-eight year old non-traditional student, who wanted to teach English and Biology, had a strong desire to teach creationism in the high school classroom. This study then evolved into a case study of the changes in that student's attitude and beliefs towards the teaching of creationism as a result of her personal inquiry.

Significance

Pre-service science teacher candidates have constructed knowledge, attitudes, assumptions, beliefs, and values about education in general and science teaching in particular. They come to teacher education programs with (a) well-established teacher role identities (Crow, 1987); (b) an extensive inventory of "personal practical knowledge composed of such experiential matters as images, rituals, habits, cycles, routines, and rhythms" (Connelly & Clandinin, 1985, p. 194-195); (c) very strong convictions about teaching and intentions on how to teach (Clark, 1988); (d) beliefs about effective teaching (Perry & Rog, 1990); (e) cognitive structures on teacher planning (Beyerbach, 1988); and (f) preexisting knowledge structures [on teaching] (Stoddart & Roehler, 1990).

These pre-existing ideas can be rich, pervasive, contrary, and highly resistant to change, just as are alternative conceptions held by novice science learners (Posner, Strike, Hewson, & Gertzog, 1982). With over 10,000 hours of classroom observations and varying and disparate repertoires of beliefs and values about teaching, prospective science teachers have constructed primitive, underdeveloped knowledge that influences their teaching styles and affects their responses to teacher education programs. Book, Byers, and Freeman found that "many candidates come to formal teacher preparation believing that they have little to learn" (cited in Lanier & Little, 1986, p. 542).

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If science teacher education programs fail to address learners' prior knowledge and attitudes, preservice teachers will pass through our programs with little or no change in their values and beliefs about education (Goodlad, 1990). A teacher education program that exposes prior attitudes and beliefs of candidates to the light of critical inquiry can be the foundation for meaningful learning and result in the restructuring of knowledge about science teaching.

Design

Confrey (1990) asserted, with respect to mathematics instruction, "teachers must build models of students' understanding of mathematics" (p. 112). He continued, "the result will be that a teacher creates a 'case study' of each student." Our students "already hold a range of attitudes, perceptions, conceptions, and abilities in relation to teaching and learning" (Baird, 1989, p. 9). The constructivist approach used in this course attempted to build a model of the students' understanding of science teaching by uncovering their prior knowledge, attitudes and beliefs about teaching. Questionnaires, early microteaching lessons, concept maps of teaching, reflective papers, student learning journals and interviews helped to elaborate the rudimentary models. In addition, the students engaged in an in-depth inquiry into an issue of their own choosing in their field of study. A field paper reported on the results of that inquiry. Ten hours of observation with a master teacher enhanced their investigation. Logbooks summarized the observations, student reflections, and related experiences. Thus a case study was built up for each teacher candidate enrolled in the course. Since "data collection and analysis is a simultaneous activity in qualitative research" (Merriam, 1988, p. 119), the general study of the class led to the selection of a unique case to illuminate the change in the beliefs of preservice science teachers. What made this particular case appealing to science teacher educators was the striking change that occurred in Molly's beliefs about teaching creationism and evolution.

Procedure

Molly's personal investigation into an issue in her teaching field (the teaching of creationism) constituted the primary source for the change in her beliefs. This investigation—the focal point of the course—generated her field paper which began as library research and ended as an I-search centered around a master teacher. The paper engendered a striking analytic narrative vignette of her experience (Erickson, 1986, p. 149). Molly's learning journal and logbook, a questionnaire, her reflective papers, and open-ended as well as focused interviews produced additional data sources. The use of "multiple sources of evidence" led to the "development of converging lines of inquiry" and the corroboration of Molly's changes (Yin, 1989, p. 97). The constant comparative method of data analysis described by Glazer and Strauss (1967) validated the assertion that in this unique case, constructivist inquiry changed a preservice teachers' beliefs about teaching creationism.

Setting

Molly, mother of a three-year old, enrolled in the undergraduate introductory course of a two year sequence to prepare secondary school teachers at an urban southwestern state university. Molly wanted to be a teacher because, "it is always a learning experience and a challenge. I feel I can do something meaningful in this field."

This course provided a variety of experiences intended to engage preservice teacher candidates in self-assessment, examination of personal and practical models of teaching, and in experiences related to secondary schooling in the contemporary setting. The course centered around a constructivist perspective with a premise described by MacKinnon & Erickson (1988) as one "that individuals construct their own meaning of new information and ideas on the basis of their existing knowledge; learning is not a matter of passively taking up 'static' information" (p. 121). The syllabus informed the students that,

> by investigating the assumptions and beliefs that you now hold about teaching, by exposing them to the light of critical inquiry, you will be able to develop a solid rationale for teaching and grow into reflective teachers who create solutions to learning problems.

The teacher candidates completed a questionnaire modeled after Weinstein (1989), an early concept map on teaching, an issues paper and presentation, and a field paper which investigated an issue, topic or problem in their field of teaching. They kept a learning journal and wrote reflective papers on topics relating to their high school experience, educational heroes and villains, high and low-points in their learning, and what their classroom would be like after they were teaching for five years. They presented a short microteaching lesson and participated in a thirty minute open-ended interview with this investigator. (Some students underwent follow-up focused interviews.) All of the assignments were designed to stimulate inquiry, reflection, and the construction and restructuring of their knowledge base on teaching.

Findings

On her questionnaire at the beginning of the course Molly described her strengths as, "motivated , caring/sensitive, openminded, and creative." She considered her weaknesses as, "fearful, not enough confidence, too soft spoken." At the beginning of the course she felt that knowledge is best produced by "lecture or share knowledge then have activities that will help students apply knowledge learned." In her mind, "learning can only occur if at first the mind is prepared to soak in information—students attention. Knowledge is clearly presented and then applied by the student."

Molly demonstrated reflective and analytical thinking early in the course. Her response to her microteaching made her "analyze how I want to teach and what I really want to accomplish when I become a teacher." She

was analyzing her lesson in which she taught the class to count to ten in french. "Counting to ten seemed like a simple and clear concept to teach in five minutes." In her interview she added that she "wanted the class to be doing something." She continued. "application is the best way to really learn something and I feel that this is especially important in the teaching field." Her view of a teacher as dispenser of information to be followed up be some activity or application by the students was clear as she began the course.

Molly wanted "to teach literature because [she felt] it is very important to partake of experiences that one may not be able to experience in the realm of their own life. These experiences through reading help to widen one's perspective of life so that one can be a well-rounded and open minded human being. Literature helps individuals reflect on their values and personal beliefs." She continued, "It is important for them [students] to learn to think critically about what they read and about the controversial issues that may arise." Molly intended to teach English Literature. She chose a second teaching field of Biology in order to make her more marketable. Why Biology? Because it was an exciting and fun course in high school. She asked for a field placement in Biology in order to get to know the field.

Molly expressed these concerns about being an open minded human being and thinking critically about controversial issues before she began to consider her field research. She didn't hesitate in choosing a controversial issue as her topic.

Before she started her field investigation she wanted to teach creationism in the biology classroom. She was a sincere and devout Mormon who believed that creation according to Genesis should be taught alongside of evolution. As she began her field work, she felt that "the most correct solution was to present both evolution and creationism in the teaching of biology in the public schools." "By presenting both of these theories in a careful manner," she reasoned that the First Amendment would "not be violated and students will gain a broad unbiased learning of the origin of life."

She wanted to "demonstrate [the] facts pertaining to the controversy of evolution vs. creationism in the biology curriculum, and also illustrate [her] initial opinion on this issue and the opinion which I adopted after I finished my research." Molly revealed that her purpose in researching this subject was to "prove that the presentation [of] creationism should be included in the biology curriculum."

She began her research with a search of the literature and presented three "solutions to the problem of teaching the origin of life"

1. evolution should be the only true theory taught/discussed
2. the subject of the origin of life should be completely avoided in public schools, or
3. both evolution and creationism should be equally treated when being taught in public schools.

She had a predisposition toward teaching both approaches shortly after she began her research; however she felt troubled because it was "indeed very

difficult to decide which solution would provide the best education for the students without violating the First Amendment of the Constitution." Molly then traced the history of the teaching of evolution in our public schools. "By the 1970s" she stated, "evolution became widely accepted by our society and has proven to be a very popular theory on the origin of life."

> I found that evolution is backed by evidence of fossil records and the concepts of evolution have withstood scientific testing, evolution has proven to be a very legitimate theory which should be taught to science students in public schools. The proposal of completely avoiding the teaching of the origin of life is ridiculous and will solve nothing.

When Molly finished the library research for her field paper she sensed that it was "very important for teachers to never teach both creationism and evolution as absolute truth [italics added]." Her search of the literature led her to determine that both creationism and evolution should be taught; however, "creationism should be briefly presented as another alternative theory to evolution and explained in very short and general terms." A softening of her position in favor of giving equal time to both evolution and creationism was appearing. The field experience came next.

Molly's Transformation

As part of her assignment, Molly interviewed Mr. Watkins, a biology teacher, a master teacher who has had experience supervising student teachers, a National Association of Biology Teachers State Teacher of the Year. and head of the science department at a local high school. Mr. Watkins did not "include the discussion of creationism in his lectures unless a student asks questions pertaining to creationism, and then he will briefly address their question." He feels "comfortable discussing both evolution and creationism as long as people are able to discuss it rationally and logically, but the problem is that many people become very emotional when discussing this issue." Molly continued with her interview,

> Mr. Watkins also made the point that creationism is an 'ism'—a belief and the teaching of beliefs doesn't really belong in a science classroom. In contrast, evolution is a proven biological phenomenon, that is very necessary to the teaching and understanding of science.

Molly concluded that "to withhold this widely accepted theory [of evolution]... would hinder a student's potential of understanding the important concept of gene mutations." She found "that creationism is not based on scientific fact and ... the teaching of creationism has the potential of violating the First Amendment." To teach "creationism in as much detail as evolution is taught ... would be unconstitutional due to the religious background of the theory of creationism." She reasoned that

> the opinion [of teaching creationism or both creationism and evolution] is based on my emotional feelings on this issue. When I view this issue in a logical sense, with my personal

beliefs set aside, and take on the perspective of a future teacher, it becomes apparent that the topic of creationism does not belong in the classroom.

At the end of her field investigation, Molly concluded that as a teacher she "would not want to have the responsibility of teaching the many varieties of religious theories which relate to the origin of life." She continued, "by teaching creationism one is opening up a can of worms which may greatly detract from the teaching of science and enter the class into heated religious debate." Her attitude about teaching creationism changed. She wrote, "A science teacher is only qualified to teach science, not religious beliefs, and I now realize this limitation."

When Molly put her critical thinking skills to work in an open minded investigation she was able to restructure her beliefs about the teaching of the origin of life. She choose her research topic. She investigated the possibilities. She interviewed a superior biology teacher and concluded that her assumptions, values, and beliefs about teaching creationism had limitations in the context and setting in which they were to be applied.

Conclusion

The results of this study have clear implications for teacher candidates, teacher educators, and for science teaching in general. Merriam (1988) discusses the particularistic nature of a case study by asserting that the examination of a specific instance can illuminate a general problem. Molly's inquiry into the teaching of creationism in the classroom encourages programs that emphasize reflection and inquiry on the part of teacher candidates and helps them to "identify and defend their own perspectives" (Cronin-Jones, p. 221). Teacher educators can recognize and invite critical inquiry into attitudes and beliefs about teaching and prepare teachers with sound rationales for teaching if their views about what to teach and how to teach are tested. A constructivist approach requires that teacher candidates build, or restructure, their knowledge about teaching so that it makes sense to them. Exposing their attitudes, beliefs and values to the light of critical inquiry builds teachers who have a sense of learning--and how students learn.

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